



IDAHO STATE BOARD OF EDUCATION

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February 15, 2011

Dr. Kerry Huber
University of Idaho
606 Rayburn St., 118 Ag Science Bldg.
Moscow, ID 83844-2312

FUNDING AUTHORIZATION

Dear Dr. Huber:

The University of Idaho, School of Food Science is authorized to expend up to \$50,000 toward expenses of the project entitled "Generation of Potato-Based Resistant Starch (RS) Ingredients for Testing within Commercial Product Prototypes by an Industrial Partner". The following information applies to these funds.

Amount of Grant:	\$50,000
Project Title:	Generation of Potato-Based Resistant Starch (RS) Ingredients for Testing within Commercial Product Prototypes by an Industrial Partner
Grant Number:	IF11-013
Authorized Uses for the Funds:	Project expenditures as outlined in the budget of the approved proposal
Fiscal Period in which funds will be expended:	March 1, 2011 – June 30, 2012
Distribution of Funds:	All funds for this grant will be distributed in one lump sum in FY2011. The Institution is responsible for accounting for the funds and insuring that the money is spent on the project according to the grant guidelines.
Institutional Contact:	Gene Merrell and Polly Knutson
Progress (Financial Burn Rate) Report Due to OSBE:	June 1, 2011 September 1, 2011 December 1, 2011 March 1, 2012
Final (End-of-Project) Report Due to OSBE:	June 15, 2011

The grants and contracts officer or the designated research officer at your institution is responsible for monitoring and assisting with the administrative management of the projects and ensuring that progress and final reports are submitted by the due dates given. Any request concerning this project must be submitted via email to Patty Sanchez.

The State Board of Education and this office forward their congratulations and wish grantees the best with their projects. If you have any questions, please contact Patty Sanchez at (208) 332-1562 or patty.sanchez@osbe.idaho.gov.

Sincerely,

A handwritten signature in cursive script that reads "Mike Rush".

Mike Rush
Executive Director

cc: Doug Baker, Provost
Lloyd Mues, Financial VP

September 2011

Summary Progress Report: SBOE Idaho Incubation Fund Program (HERC)

TITLE: Generation of Potato-Based Resistant Starch (RS) Ingredients for Testing within Commercial Product Prototypes by an Industrial Partner

PI: Dr. Kerry C. Huber, University of Idaho, Moscow ID 83844-2312

Tasks to be completed:

Phase I: Bench-top Level Testing

- Prepare a range of potato resistant starch (RS) and slowly digestible starch (SDS) ingredients with variable molar substitution and/or cross-linking levels for testing in bench-top commercial product trials conducted by the industrial partner (UI task).
- Verify initial RS/SDS levels within the various modified potato RS ingredients (UI task)
- Test potato RS ingredients in bench-top commercial products at various levels of addition (J.R. Simplot Co. task)
- Evaluate processability and quality of commercial products containing varied levels of RS ingredients (J.R. Simplot Co. task)

Phase III: Validation of RS/SDS and estimated glycemic index (eGI) levels for select commercial products

- Measure RS/SDS levels and eGI values for select commercial products (UI task)

Project Progress to Date:

Preparation of Modified Potato RS Ingredients and Validation of RS Characteristics:

Project personnel, consisting of a Visiting Research Scientist (30% effort) and a Scientific Aide Senior (50% effort), were trained in the methods and protocols (previously established by Yu, 2010) for modification of potato granules, as well as measurement of rapidly digestible starch (RDS), slowly digestible starch (SDS), resistant starch (RS), estimated glycemic index (eGI), and degree of molar substitution (MS). Methods were adapted and validated to utilize potato granules manufactured by the J. R. Simplot Co. Approximately 50 lb. of commercial potato granules were obtained from the J.R. Simplot Co. for use as substrate in modification trials.

After validating methods, a primary goal was to generate sufficient quantities of potato RS ingredients in the laboratory to accommodate bench-top level testing by the J.R. Simplot Co. within their commercial products. To date, bench-top level tests of modified potato RS ingredients have been evaluated within a mashed potato product format. Four different potato RS ingredients, possessing a range of physical properties, were prepared and provided to the J.R. Simplot Co. for in-house testing. The four potato RS ingredients provided to the J.R. Simplot Co. are as follows: 1) Dual-modified (substituted and cross-linked), 2) Dual-modified plus added protein, 3) Substituted 1 (low level) and, 4) Substituted 2 (high level). Each of the four modified

potato RS ingredients was identified by a generic two-letter code so as to not to prejudice or bias the evaluations made by J.R. Simplot Co. personnel: Dual-modified (QC), Dual-modified plus added protein (TK), Substituted 1 (IA), and Substituted 2 (EB). Prior to submitting the potato RS ingredients to the J.R. Simplot Co. for evaluation, each modified potato RS ingredient was analyzed in our laboratory for RDS, SDS, RS and MS attributes (i.e., quality control measures) to verify that all modified potato RS ingredients possessed the appropriate product characteristics (Table 1). As expected, the modified potato granule RS ingredients with the highest MS values generally possessed the highest RS contents (a high RS content is desired) and the lowest RDS contents, while the untreated control potato granules possessed the highest RDS and lowest RS contents. All modified potato RS ingredients passed quality control measures, and were deemed to be appropriate for testing by the J.R. Simplot Co.

Table 1. Summary of Rapidly Digestible Starch (RDS), Slowly Digestible Starch (SDS), Resistant Starch (RS) and Molar Substitution (MS) Characteristics for Modified Potato Granule RS Ingredients provided to the J.R. Simplot Co. for In-house Testing.

Treatment	RDS	SDS	RS	MS ³
Substituted 1 (IA)	55.619	0.000	26.430	0.1911
Substituted 2 (EB)	34.422	1.668	45.836	0.3742
Dual Modified (QC)	53.598	1.080	27.248	0.1799
Dual Modified with added Protein ² (TK)	56.135	0.000	25.853	0.1929
Simplot Potato Granules (Untreated Control)	66.778	0.000	2.487	N/A

Commercial Evaluations of Modified Potato RS Ingredients by the J.R. Simplot Co.:

Evaluation of the modified potato RS ingredients in an instant mashed potato format by J.R. Simplot Co. personnel was coordinated through Stephen Vernon, Vice-President of Research and Quality Assurance. The four modified potato granule RS ingredients were prepared as mashed potatoes using the standard method developed for Simplot Traditions instant mashed potatoes made from agglomerated flakes. One part of modified potato RS ingredient was mixed with five parts of boiling water, after which the wetted mixture was mixed with a spoon and allowed to hydrate. Observations were made on the basis of water absorption, color, texture, and aroma. A control product (utilized as the reference or standard) based on Simplot Traditions dehydrated commercial instant mash potatoes was prepared for comparison purposes. Written observations for mash made from each modified potato granule RS ingredient, as well as visual images of the prepared potato mash samples (Figure 1), are contrasted below.

- Sample QC. Very fast hydration....within 5 seconds which is much faster than Simplot Traditions (control). Bland aroma. Color is darker and more tan than control. No graininess. Texture is short (easily breaks and does not form peaks). Not very sticky. Only one sample was less cohesive (TK).
- Sample IA. Again, very fast hydration. Bland aroma and the same tan color. Short texture. The cohesiveness of this product was less than EB but more than TK.
- Sample EB. Hydrated fast but the hydration visual was different. The product was more viscous. Some non hydrated lumps observed. Bland aroma, slightly lighter color

- than QC or IA. Texture was stickier and more cohesive once it was cooled. This might suggest a stick mash texture, which would not be desirable.
- Sample TK. Fast hydration, bland aroma, the typical tan color (but slightly darker). Very short texture. Behaves like the control mash when pushed around with a fork.

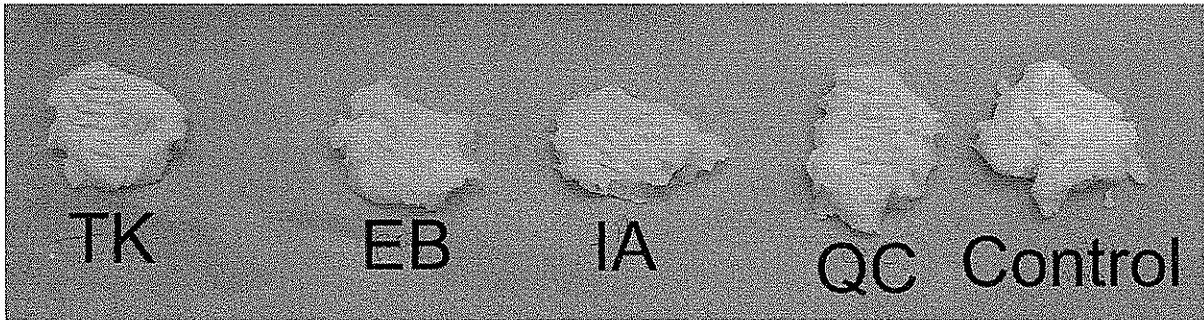


Figure 1. Comparison of mashed potatoes made from the four modified potato granule RS ingredients, as well as the commercial control (Simplot Traditions Instant Mashed Potatoes).

J.R. Simplot Co. Summary: Based on the performance of the modified potato granule RS ingredients prepared as mashed potatoes, J.R. Simplot Co. personnel were upbeat about the results of these initial experiments. Three of the four modified potato RS ingredients possessed favorable mashed potato textures (only EB was deemed to have inferior texture).

Estimated Glycemic Index (eGI) Values for Mashed Potatoes made from Potato RS Ingredients:

All modified potato RS ingredients and an unmodified control (Simplot Potato Granules) were prepared as mashed potato products as described in the previous section, and analyzed for *in vitro* estimated glycemic index (eGI) (Table 2). Estimated glycemic index (eGI) values for

Table 2. In vitro Digested Starch Content and Estimated Glycemic Index (eGI) Values for Mashed Potatoes made from Modified Potato RS Ingredients.

Modification Treatment	Digested Starch Content (%)	eGI
With Simplot Potato Granules		
Substituted 1 (IA)	59.2	86.8
Substituted 2 (EB)	35.2	67.5
Dual Modified (QC)	54.4	82.9
Dual Modified with added Protein (TK)	53.4	82.1
Simplot Potato Granules (Untreated Control)	90.0	111.5

mashed potato products prepared from modified potato RS ingredients were reduced 22-40% relative to the Simplot potato granule control, indicating a slower rate of glucose uptake for modified potato granule RS ingredients.

Other Progress and Next Steps:

- Further batches of modified potato granule RS products have been prepared and sent to the J.R. Simplot Co. for bench-top level testing in additional potato product applications (i.e., potato croquettes, restructured products, etc.). Feedback from such tests is anticipated to be received from the J.R. Simplot Co. within the coming weeks, and will provide essential direction for future modifications to potato RS ingredients.
- A face-to-face meeting between UI researchers and J.R. Simplot personnel will occur in October 2011 to discuss larger-scale production of modified potato RS ingredients to generate sufficient quantities for pilot-scale application testing by the J.R. Simplot Co. This round of testing will evaluate the ability of modified potato RS ingredients to be processed by larger-scale production equipment utilized for processing of commercial-scale potato products.
- Since this grant has been initiated, there have been multiple face-to-face meetings between UI researchers, UI intellectual property officers, and J.R. Simplot technical and business personnel to discuss future research needs and commercialization strategies associated potato RS ingredients.